

# PATENT ABSTRACTS OF JAPAN

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## (54) INK JET RECORDING SHEET

### (57)Abstract:

PURPOSE: To obtain an ink jet recording sheet capable of reducing the occurrence of ink absorption irregularity causing the lowering of image quality, eliminating the undulation of the sheet causing the lowering of a grade and suppressing the enlargement of a dot due to the adhesion of moisture causing the lowering of colorfulness or sharpness.

CONSTITUTION: In a coated type ink jet recording sheet, the outermost layer is an ink fixing layer composed of a compsn. based on cationic colloidal particles and the ink fixing layer is subjected to calendering treatment by a specific calender device.

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## CLAIMS

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[Claim(s)]

[Claim 1] The ink-jet record sheet characterized by to be the ink fixation layer which the maximum surface of this record sheet turns into from the constituent which makes a cationic colloidal particle a subject in the ink-jet record sheet with which the coated layer of one or more layers was prepared on the base material, and to be what calender processing is carried out and this ink fixation layer becomes with the calender equipment which consists of a heated metal roll and a synthetic-resin roll so that this metal roll may make contact after painting this ink fixation layer.

[Claim 2] The ink jet record sheet according to claim 1 with which the ink absorption layer which consists of a constituent which adjoins the maximum surface and makes a pigment and adhesives a subject between base materials is characterized by being painted.

[Claim 3] The ink jet record sheet according to claim 1 or 2 characterized by a base material consisting of a constituent which makes wood pulp a subject.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] About an ink jet record sheet, especially, this invention controls the wave on the front face of a sheet, and relates to the ink jet record sheet which is the high-definition image quality which avoided ink absorption nonuniformity, and avoided hypertrophy of the diameter of a dot resulting from the moisture-further adhesion under a high humidity environment.

[0002]

[Description of the Prior Art] Although an ink jet recording method makes the minute drop of ink fly by various working principles, and is made to adhere to record sheets, such as paper, and an image, an alphabetic character, etc. are recorded, the development-fixation with the large versatility of ease [ a high speed, the low noise, and multiple color-izing ] and a record pattern has the descriptions, such as needlessness, and has spread quickly in various applications including the kanji as recording devices, such as various graphic forms and a color picture. Furthermore, the image formed by the multicolor ink jet method can acquire equal record as compared with the print by process printing by the platemaking method, or the color photography method. Moreover, in the application with which there is few creation number of copies and it can be managed, since it is cheap rather than it is based on a photograph technique, it is widely applied even to the full color image recording field.

[0003] Efforts have accomplished from equipment or the field of an ink presentation in order to use the paper of fine quality and coated paper which are used for usual printing and a usual note as a record sheet used by this ink jet recording method. However, a more advanced property came to be required also from the record sheet with improvement in engine performance of an ink jet recording device, such as improvement in the speed and highly-minute-izing, or full-color-izing of equipment, or amplification of an application. That is, also when a printing dot laps [ that it is high, a color tone is bright, and the

concentration of a printing dot is vivid as the record sheet concerned, and absorption of ink ] early, the diffusion to the longitudinal direction of ink flowing out or not spreading and a printing dot is not large beyond the need, and high image repeatability, like the circumference is smooth and does not fade is required.

[0004] Some proposals have been made from the former to such a demand. For example, the ink acceptance layer used as the opening layer which used the silica system pigment as the principal component was prepared in the support surface, and the device which raises ink absorptivity has been made (JP,52-9074,A, 58-72495 official report, etc.). In order to obtain the printing dot which does not have raising, and high printing dot concentration or an ink blot in ink absorptivity by this ink acceptance layer, JP,55-51583,A and JP,56-157,A have the proposal which blends non-colloid silica powder. Moreover, paying attention to color nature and clear nature being in the distribution condition in the ink acceptance layer of the color in ink, the proposal (JP,55-144172,A) using specific \*\* which adsorbs a color component has also been made.

[0005] However, when an ink acceptance layer is the amount of low coating which is about [ 1-10g //m ] two, the printed ink cannot be received only in an ink acceptance layer, but ink absorptivity is needed also for a base material. Although ink absorptivity is good when a base material uses the base material of whenever [ low size ], although the property of low size is needed, ink permeates in the thickness direction of a base material deeply, and the problem of a strike-through arises from this. Furthermore, there is generating of the uneven dot configuration called the feather ring (Feathering) which ink diffused in the direction of a field of a base material, and carried out the notch to the shape of feather of a bird.

[0006] It is necessary to increase the amount of coating of an ink acceptance layer, and to absorb ink only in an ink acceptance layer from this. However, neither the increase of the amount of coating nor the amount of coating although generating of a strike-through and a feather ring can be controlled if it carries out and ink absorptivity is raised, since it becomes easy to produce adhesive lowering and the powder omission of an ink acceptance layer can be easily increased in order to suppress osmosis of ink in an ink acceptance layer.

[0007] Furthermore, in the coating process which prepares an ink acceptance layer in a support surface, the binder and solvent (mainly water) in an ink acceptance layer application constituent permeate into a base material, or a binder moves to an ink acceptance layer front face in a desiccation process. Consequently, ununiformity-ization of binder distribution of the direction of a field of an ink acceptance layer and the thickness direction progresses, and the problem from which ink absorption also becomes uneven arises. Furthermore, not only binder distribution but the thing resulting from consistency nonuniformity has the heterogeneity in an ink acceptance layer, and if it is good to make the consistency of an ink acceptance layer regularity and it also fixes the consistency of a base material, still more uniform ink absorptivity will be acquired. Color mixture extent of ink changes and uneven ink absorptivity makes sharp nature differ from color nature in the image which consists of generating and two or more ink of printing concentration nonuniformity. Since the diameter sizes of a dot differ selectively in connection with uneven ink absorptivity especially, an image serves as spots and the grace of an image is made to fall greatly in the highlights section.

[0008] The actual condition is that many attempts which control the size nature of a base

material or control a desiccation burden at the desiccation process at the time of coating are performed from this. Moreover, although efforts to equalize the mass distribution of a base material or an ink acceptance layer in order to cancel consistency nonuniformity are performed, completely uniform mass distribution is not acquired. For this reason, although it is desirable to make the thickness of a base material or an ink acceptance layer agree in those mass fluctuation, and to make a consistency regularity, in the actual condition, it is a quite difficult technique. If it is going to obtain a more uniform consistency with the present technique, it is necessary to decrease thickness considerably. However, since a consistency rises simultaneously, the heterogeneity of binder distribution of an ink acceptance layer is made to emphasize, and reverse is made to promote ununiformity-ization of ink absorptivity.

[0009] Moreover, since the amount of openings of an ink acceptance layer or a base material will reduce lifting of a consistency In the color overlapping section with which ink laps by osmosis of the ink to an ink acceptance layer or a base material serving as delay, and ink serving as un-drying and by which dot printing is carried out Ink overflows around a dot, or the device of the transport-device circumference is contacted during conveyance of the sheet within an ink jet recording device, a dot is worn, the dot called a greasing is worn, dirt is generated, and it becomes the image which spoils a fine sight. Furthermore, also diversifying the environment where an ink jet record sheet is used, it being used also under a high humidity environment, and the ink by moisture adhesion oozing out in that case, or runoff of ink arising, and reducing image grace greatly by the spread of ink jet recording methods, is also posing a problem.

[0010] On the other hand, the demand to evasion of the wave generated not only on reservation of high printing concentration or good ink absorptivity but on a sheet of a visualization-oriented rise of recent years is also high. External waviness generating of a sheet is lower than the value by which it not only spoils a fine sight, but printing concentration was evaluated objective after printing, and since it looks subjectively, it serves as the same semantics as lowering of color nature arose. Therefore, the demand of the ink jet record sheet which removed generating of this wave is also high. When the base material already has generating of this wave potentially, a coated layer is prepared and it is generated, it is difficult for the actual condition to avoid generating of the wave produced especially in a coat type ink jet record sheet when a coated layer is prepared by combination and the manufacture approach of an ink jet record sheet, by generating after printing, although those cures are performed.

[0011]

[Problem(s) to be Solved by the Invention] In view of this actual condition, the object of this invention has uniform ink absorptivity, and it is to obtain the coat type ink jet record sheet which avoided the hypertrophy of the diameter of a dot which it surges and is generated under a high humidity environment further generated on a sheet front face.

[0012]

[Means for Solving the Problem] this invention person etc. by the constituent which makes a specific pigment a subject constituting the coated layer of this record sheet, as a result of repeating various examination, and carrying out calender processing of this coated layer with further specific calender equipment about an ink jet record sheet Ink absorptivity is uniform, evasion of the wave generated on a sheet front face is possible, hypertrophy of the diameter of a dot which originates in moisture adhesion further was

controlled, and it found out that the object of this invention resulted in completion. Namely, this invention is set to the ink jet record sheet with which the coated layer of one or more layers was prepared on the base material. It is the ink fixation layer which the maximum surface of this record sheet turns into from the constituent which makes a cationic colloidal particle a subject. And the ink jet record sheet characterized by being what calender processing is carried out and this ink fixation layer becomes with the calender equipment which consists of a heated metal roll and a synthetic-resin roll so that this metal roll may be made to contact after painting this ink fixation layer is offered.

[0013] Hereafter, the ink jet record sheet of this invention is explained to a detail. The ink jet record sheet of this invention is an ink jet record sheet which gave the function to fix most color components in ink to the coated layer (for it to abbreviate to an ink fixation layer hereafter) of the maximum surface to, and the function to make reduction of the opening of this maximum surface mitigate, and to make the solvent component in ink absorb was also made to accompany by further specific calender processing.

[0014] Generally the coated layer which consists of porous inorganic pigments, such as porous composition amorphous silica and porous carbonic acid amorphous magnesium, is painted on a base material, and the ink jet record sheet which was compatible in ink fixable and ink absorptivity is manufactured. Moreover, although the cure which this color fixing agent reacts with the  $-SO_3Na$  radical which is a color component in ink,  $-SO_3H$  set, two  $-NH(s)$ , etc., forms an insoluble salt in water, and secures a water resisting property with the cationic color fixing agent which consists of secondary amine, tertiary amine, and quarternary ammonium salt is also performed About the ink by moisture adhesion oozing out, since the dissolution of this color component and this unreacted color fixing agent arises, it is difficult to avoid.

[0015] However, in order to control lowering of the opening of this coated layer by processing with the calender equipment which consists of a metal roll which it has [ roll ] ink fixation ability and had this coated layer heated, and a synthetic-resin roll, as for the coated layer which makes a cationic colloidal particle a subject as shown in this invention, it is possible to make ink absorbing power add, and it can avoid generating of ink absorption nonuniformity. Moreover, in order that the dissolution of this particle itself may not follow, the ink by moisture adhesion oozes and it excels also in the point of \*\*. Since the layer which this coated layer is adjoined, the color component in ink will be fixed on the maximum surface of this record sheet if the layer which absorbs the solvent component in ink is prepared, and adjoins especially can be made to absorb the solvent component in ink, it is desirable.

[0016] The particle which carried out alumina coating of the colloid silica particle front face as the cationic colloidal particle concerning this invention carries out suspension distribution underwater, is making colloid, and pointed out the particle to which this particle front face was just charged, for example, it was indicated by alumina sols, such as boehmite and pseudo-boehmite, a colloidal alumina, a cationic aluminum oxide, its hydrate, or JP,47-26959,B is mentioned.

[0017] Although this colloidal particle has adhesion ability in itself, it can use adhesives for this ink fixation layer according to the coated layer reinforcement demanded. As adhesives, the Nonion nature, cationic adhesives, Nonion-izing, or the cation--ization-embellished adhesives is desirable among the adhesives mentioned later. As loadings It is 2 - 50 weight section to the pigment 100 weight section which constitutes this ink

fixation layer. Under in 2 weight sections If lowering of chip box crack reinforcement becomes remarkable and exceeds 50 weight sections, in order to reduce the ink absorptivity to a base material, an ink overflow may arise depending on the class of ink jet recording device, or it may check the ink fixable in this ink fixation layer.

[0018] By painting so that this colloidal particle may become two or more [ 0.5g //m ], this ink fixation layer can discover ink fixable, and it uses together with this colloidal particle, and it can also apply a well-known pigment conventionally. The amount of painting becomes possible [ obtaining the aesthetic property ] by increasing the amount of painting of this ink fixation layer, when it is related also to the aesthetic property of this record sheet and aesthetic property of coat paper is desired. Moreover, in order to obtain the aesthetic property of a stencil or a general newspaper, when the amount of painting needs to be reduced, or when capturing the color component in the ink of each color to specification for the purpose of control of color nature, it is also possible to use a cationic color fixing agent together.

[0019] Furthermore, a color fixing agent, pigment agent, thickener, fluid amelioration agent, defoaming agent, foam suppressor, release agent, foaming agent, penetrating agent, coloring color, color pigment, fluorescent brightener, ultraviolet ray absorbent, anti-oxidant, antiseptics, \*\* motorcycle agent, deck-watertight-luminaire-ized agent, humid paper reinforcing agent, and desiccation paper reinforcing agent etc. can also be suitably blended with this ink fixation layer as an additive.

[0020] Moreover, since ink absorptivity is added by preparing the coated layer (following and ink absorption layer) which adjoined this ink fixation layer and used a well-known pigment and adhesives as the principal component conventionally between base materials, the ink jet record sheet concerning this invention becomes possible [ heightening the effectiveness of this invention further ].

[0021] In case this ink fixation layer or an ink absorption layer is prepared, as coating or equipment which sinks in, various equipments, such as various blade coaters, a roll coater, an air knife coater, bar coater, rod blade coater, curtain coater, short dwell coater, size press, and a spray, are mentioned, and they can be used by the on-machine or the off-machine. Moreover, after coating or impregnation, you may finish using calenders, such as a machine calender, TG calender, a supercalender, and a software calender. Moreover, in case this barrier layer is prepared with thermoplastics, generally a laminator is used.

[0022] As long as it has at least 1 or more sets of metal rolls and synthetic-resin rolls and this calender equipment can install two or more rolls, the calender equipment concerning this invention may put side by side the combination of a metal roll, a metal roll and a metal roll, a cotton roll or a synthetic-resin roll, and a synthetic-resin roll forward and backward, may process it multistage, and the calender equipment which has arranged the above-mentioned roll combination may install separately, and it may process it.

[0023] In the calender processing concerning this invention, it is necessary to contact an ink fixation layer painting side and a metal roll side. Moreover, since it is considerably related to the consistency nonuniformity of this record sheet after calender processing and high temperature processing can mitigate generating of consistency nonuniformity, the skin temperature of the metal roll at the time of calender processing is desirable.

Although it changes with calender processing speed or linear pressures, and the skin temperature of a metal roll has desirable 100 degrees C or more, when it exceeds 300 degrees C, for a certain reason, it is also 100-300 degrees C as optimal temperature that

lowering of the whiteness degree of this record sheet called black NINGU arises. Moreover, although many carbon steel construction material is used for a metal roll, especially construction material is not limited. Furthermore, thermal spraying of a ceramic, the chromium, etc. may be carried out, and a roll surface may be protected.

[0024] Moreover, as construction material of a synthetic-resin roll, synthetic resin, such as an urethane system, an ebonite system, a nylon system, and an aramid system, is used, and it is JIS as a degree of hardness. 70 or more HsD(s) are desirable at the shore hardness of Z2246 convention. Since the synthetic-resin roll is soft, this degree of hardness needs to raise a linear pressure at less than 70 HsD, and the problem of an ink overflow may arise. Although an iron core and the surface section consist of synthetic-resin layers of the above-mentioned construction material for a center section, as for the synthetic-resin roll, the synthetic-resin layer may be a multilayer.

[0025] As a base material used by this invention, chemical pulp, such as LBKP and NBKP, Wood pulp, such as recycled pulp, such as mechanical pulp, such as GP, PGW, RMP, TMP, CTMP, and CMP, CGP, and DIP, and a conventionally well-known pigment are used as a principal component. A binder and a sizing compound and a fixing agent, a yield improver, a cation-ized agent, One or more sorts are mixed using various additives, such as a paper reinforcing agent. A Fortlinear paper machine, a cylinder machine, Coated paper, such as a stencil manufactured with various equipments, such as a twin-wired paper machine, a stencil which prepared size press and the anchor coat layer in starch, polyvinyl alcohol, etc., and the art paper and coat paper which prepared the coat layer on them, a cast-coated paper, is also further contained in a stencil. The coated layer which starts this invention as it is may be prepared in such a stencil and coated paper, and calender equipments, such as a machine calender, TG calender, and a software calender, may be used for them in order to control flattening.

[0026] Moreover, as a base material, a polyolefin resin layer may be prepared on the above-mentioned stencil, and application on synthetic resin, such as polyethylene, polypropylene, polyester, nylon, rayon, and polyurethane, the film material of such mixture, and the sheet that fibrosed and cast this synthetic resin is also possible.

[0027] One or more sorts of well-known white pigments can be used for the base material used for this invention or the pigment used together with the cationic colloidal particle of an ink fixation layer, and an ink absorption layer. For example, precipitated calcium carbonate, whiting, a kaolin, talc, A calcium sulfate, a barium sulfate, a titanium dioxide, a zinc oxide, zinc sulfide, Zinc carbonate, a satin white, aluminum silicate, the diatom earth, a calcium silicate, A magnesium silicate, synthetic amorphous silica, colloidal silica, a colloidal alumina, Pseudo-boehmite, an aluminum hydroxide, an alumina, a lithopone, a zeolite, Organic pigments, such as white inorganic pigments, such as hydrated halloysite, a magnesium carbonate, and a magnesium hydroxide, a styrene system plastics pigment, an acrylic plastics pigment, polyethylene, a microcapsule, a urea-resin, and melamine resin, etc. are mentioned. Especially, a porous inorganic pigment is desirable in an ink absorption layer, and porous composition amorphous silica, a porous magnesium carbonate, and a porous alumina are mentioned to it. Moreover, in order to give curl fitness, it is also possible to paint a back coat layer on the reverse side of the ink fixation layer which sandwiched the base material, and a plate-like pigment and hydrated halloysite are desirable as a pigment in that case.

[0028] As adhesives, for example Moreover, polyvinyl alcohol, vinyl acetate, Cellulosics,

such as oxidization starch, etherification starch, a carboxymethyl cellulose, and hydroxyethyl cellulose, Casein, gelatin, soybean protein, silyl denaturation polyvinyl alcohol, etc.; Maleic-anhydride resin, Conjugated diene system copolymer latexes, such as a styrene-butadiene copolymer and a methyl methacrylate-butadiene copolymer; The polymer or copolymer of acrylic ester and methacrylic ester, acrylic polymer latexes [, such as a polymer of an acrylic acid and a methacrylic acid, or a copolymer, ]; -- functional-group denaturation polymer latex; by functional-group content monomers, such as a carboxyl group of vinyl system polymer latexes [, such as an ethylene-vinyl acetate copolymer, ]; or these various polymers, -- melamine resin -- Aquosity adhesives, such as heat-curing synthetic-resin systems, such as a urea-resin; synthetic-resin system adhesives, such as polymethylmethacrylate, polyurethane resin, an unsaturated polyester resin, a vinyl chloride-vinyl acetate copolymer, a polyvinyl butyral, and an alkyd resin, are mentioned, and it is used by one or more sorts.

[0029] Furthermore, a pigment agent, thickener, fluid amelioration agent, defoaming agent, foam suppressor, release agent, foaming agent, penetrating agent, coloring color, color pigment, fluorescent brightener, ultraviolet ray absorbent, anti-oxidant, antiseptics, \*\* motorcycle agent, deck-watertight-luminaire-ized agent, humid paper reinforcing agent, and desiccation paper reinforcing agent etc. can also be suitably blended as other additives.

[0030] The water color ink as used in the field of this invention is the following coloring agent, a solvent object, and a record liquid that consists of other additives. As a coloring agent, water soluble dye, such as direct dye, acid dye, basic dye, reactive dye, or a food dye, is mentioned.

[0031] As a solvent of ink, water and water-soluble, various organic solvents, for example, methyl alcohol, Ethyl alcohol, n-propyl alcohol, isopropyl alcohol, n-butyl alcohol, sec-butyl alcohol, tert-butyl alcohol, Alkyl alcohols of the carbon numbers 1-4 of isobutyl alcohol etc.; Dimethylformamide, Amides, such as dimethylacetamide; Ketones, such as an acetone and diacetone alcohol, or a ketone-alcohol; tetrahydrofuran, Ether, such as dioxane; Polyalkylene glycols; ethylene glycol, such as a polyethylene glycol and a polypropylene glycol, Propylene glycol, a butylene glycol, triethylene glycol, 1, 2, 6-hexane triol, thiodiglycol, hexylene glycol, alkylene groups, such as a diethylene glycol, - 2-6 alkylene glycol; -- a glycerol -- The low-grade alkyl ether of polyhydric alcohol, such as ethylene glycol methyl ether, the diethylene-glycol methyl (or ethyl) ether, and the triethylene glycol monomethyl ether, is mentioned. Also in the water-soluble organic solvent of these many, the low-grade alkyl ether of polyhydric alcohol, such as polyhydric alcohol, such as a diethylene glycol, the triethylene glycol monomethyl ether, and the triethylene glycol monoethyl ether, is desirable. As other additives, PH modifier, a sequestering agent, an antifungal agent, a viscosity controlling agent, a surface tension regulator, a wetting agent, a surfactant, a rust-proofer, etc. are mentioned, for example.

[0032] The ink jet record sheet in this invention may not stop at the activity as an ink jet record sheet, but may be used as what kind of record sheet which uses liquefied ink at the time of record. The thermofusion nature ink which uses the thermofusion nature matter, dyes and pigments, etc. as a principal component For example, a resin film, The ink sheet applied on thin base materials, such as high density paper and a synthetic paper, is heated from the rear face. Heating fusion of the television sheet for thermal transfer recording and thermofusion nature ink which are made to carry out melting of the ink and imprint it

is carried out. The formation of a minute drop, The television sheet corresponding to the sensitization pressure-sensitive mold donor sheet using the microcapsule which connoted the ink jet record sheet which carries out flight record, the ink jet record sheet using the ink which dissolved the oil color in the solvent, a photopolymerization mold monomer, and colorless or colored dyes and pigments etc. is mentioned. The common feature of these record sheets is a point that ink is in a liquid condition at the time of record.

Liquefied ink goes as osmosis or \*\* by hardening, solidification, or fixation to the depth direction or horizontal direction of an ink acceptance layer of a record sheet. The various record sheets mentioned above need the absorptivity according to each method, and even if it uses as various kinds of record sheets which mentioned above the ink jet record sheet of this invention, they are not cared about at all. Furthermore, it may consider as the record sheet which carries out heating fixation of the toner of the electrophotography recording method currently widely used for the copying machine, the printer, etc., and the ink jet record sheet in this invention may be used. Moreover, it is also possible to paint a binder layer on the reverse side in which this ink fixation layer was prepared on both sides of the base material, and to apply to a label application.

[0033]

[Function] In order that the ink fixation layer which consists of a constituent which makes a cationic colloidal particle a subject may capture ink on a surface, an image with high printing concentration is obtained. moreover, the ink which moisture adheres to the printing section which poses a problem, and is generated under a high humidity environment -- oozing out -- it is fewer than the coated layer containing the cationic color fixing agent generally applied, and the ink jet record sheet with which the water resisting property was secured is obtained.

[0034] Furthermore, it sets to manufacture of an ink jet record sheet. In order to secure the conveyance nature within an ink jet recording device for the purpose of adjustment of the smooth nature of this record sheet Or for the purpose of clearance of desiccation Siwa produced during manufacture Calender processing has been carried out with the calender equipment called the machine calender which combined two or more calender equipment metallurgy group rolls which combined two or more the metal roll and elastic rolls with a comparatively low degree of hardness, such as cotton material, which are called a supercalender, and metal rolls. As opposed to these objects however, in the case of a supercalender The processing conditions which raised the linear pressure are needed, and lowering of ink absorptivity arises, and in being a machine calender In order to make the consistency nonuniformity of this sheet emphasize in the wood pulp which has mass distribution potentially in order to make thickness of a sheet regularity, and the base material constituted considering a pigment as a principal component, there is generating of ink absorption nonuniformity and achievement of the object of this invention is difficult. However, if it processes with the calender equipment which consists of a synthetic-resin roll and a metal roll as compared with supercalender processing and machine calender processing, since there is little consistency nonuniformity, ink absorption nonuniformity is controlled, there is still less lowering of an opening and this sheet of a low consistency will be obtained, the ink jet record sheet excellent also in ink absorptivity is obtained.

[0035] Moreover, the wave produced when the coated layer which poses a problem in a coat type ink jet record sheet is prepared is generated by contraction including this base

material, when the amount nonuniformity of coating of a coated layer, desiccation nonuniformity, or a base material has absorptivity. From this, in order to cancel this wave, equalization of the amount profile of coating and a desiccation profile, tension control at the time of manufacture, calender processing, etc. are performed. Especially, although thickness fluctuation which caused the wave is made into min and the dissolution of a wave is achieved, since the thickness of this record sheet is controllable in calender processing, in order to obtain the dissolution of the wave to satisfy, it is necessary to choose quite severe calender processing conditions with the calender equipment of a supercalender or a machine calender generally used. Consequently, since ink absorptivity falls in order that the openings of this record sheet may decrease in number, or the consistency nonuniformity of this record sheet is promoted, ununiformity-ization of ink absorptivity, i.e., ink absorption nonuniformity, occurs. However, in the calender processing concerning this invention, while it can be compatible in the property of the wave and ink absorption nonuniformity which are an opposite property and canceling a wave, generating of ink absorption nonuniformity is also mitigable. While this sheet from which this was obtained by this calender processing graduates near a coated layer front face and the thickness fluctuation which is the cause of generating of a wave becomes small, it is surmised that it originates in reduction of the opening inside a coated layer being mitigable.

[0036]

[Example] Although the example of this invention is given and explained below, this invention is not limited to these examples. Moreover, especially the "section" and "%" shown in an example, unless it shows clearly, weight section and weight % is shown.

[0037] To the wood pulp 100 section which consists of the LBKP(freshness 400mlcsf)80 section and the NBKP(freshness 480mlcsf)20 section, the ratio of precipitated calcium carbonate / whiting / talc milled the pigment 20 section of 10/10/10, the commercial alkyl ketene dimer 0.10 section, the commercial cation system acrylamide 0.03 section, the commercial cation-ized starch 1.0 section, and the sulfuric-acid band 0.5 section with the Fortlinear paper machine after preparation, and example 1 base material obtained the base material of basis weight 90 g/m<sup>2</sup>.

[0038] The ink fixation layer was prepared in the support surface. It used as the hydrated alumina (made in [ industrial company ] formation [ KATAROIDO AS-3; primary particle diameter of about 10nm: Catalyst ]) 100 section as a cationic colloidal particle, and it used the polyvinyl alcohol (PVA117: Kuraray Co., Ltd. make) 30 section as the principal component as adhesives, and the constituent of an ink fixation layer prepared it so that it might become 10% of solid content concentration. Using the air knife coater, coating of this coating liquid was carried out so that it might be set to the amount of desiccation coating of 5g/m<sup>2</sup>, and it dried so that the moisture after desiccation might become 6%.

[0039] Subsequently, using the calender equipment which consists of the metal roll and resin roll of the conditions shown below, calender processing was performed by 1 nip so that an ink fixation layer might contact a metal roll, and the ink jet record sheet of an example 1 was obtained.

The skin temperature of a metal roll : 150 degrees C Shore hardness of a synthetic-resin roll : Hsd90 Linear pressure : 150 kg/cm Rate : 200 m/min [0040] Example 2 base material was obtained like the example 1. The ink fixation layer was prepared on the base

material. As a cationic colloidal particle, as the cationic colloidal silica (Snow tex-AK [ 3; primary ] particle diameter of 10-20nm: Nissan Chemical Industries, Ltd. make) 100 spherical section which carried out cation denaturation by the aluminum oxide hydrate, and adhesives, the application constituent of an ink fixation layer used as the principal component the polyvinyl alcohol 30 section used in the example 1, and it prepared it so that it might become 10% of solid content concentration. Using the air knife coater, coating of this coating liquid was carried out so that it might be set to the amount of desiccation coating of 3g/m<sup>2</sup>, and it dried so that the moisture after desiccation might become 6%. Subsequently, except having made skin temperature into 200 degrees C among the calender processing conditions of an example 1, and having made the linear pressure into 100 kg/cm, calender processing is performed as being the same as that of an example 1, and it is ink jet record sheet \*\*\*\* of an example 2.

[0041] after extruding example 3 base material fibrous from the die head which carries out the heating dissolution of the pellet of high-density-polyethylene resin, and has pore at a head by the span bond method, it elongates fiber by the high-speed flow -- making -- the diameter of fiber -- about 1-200 micrometers -- carrying out -- fiber -- orientation -- thermal melting arrival is carried out -- making -- fabricating -- the -- post heating calender processing was carried out and it considered as the basis weight of 56g/the sheet of m<sup>2</sup> for the Beck smoothness 57 seconds.

[0042] The ink fixation layer was prepared in this sheet front face. The constituent of an ink fixation layer, coating conditions, and desiccation conditions presupposed that it is the same as that of an example 1. Subsequently, calender processing was performed on the same conditions as an example 2, and the ink jet record sheet of an example 3 was obtained.

[0043] Example 4 base material was obtained like the example 1. Before preparing an ink fixation layer, the ink absorption layer was prepared on this base material. It was made as the synthetic amorphous silica (fine seal X37B: Tokuyama Soda Co., Ltd. make) 100 section as a porous pigment, it made the subject the polyvinyl alcohol (PVA117: Kuraray Co., Ltd. make) 30 section as adhesives, and the constituent of an ink absorption layer prepared it at 15% of solid content concentration, and by the air knife coater, coating was carried out and it was dried so that it might be set to the amount of desiccation coating of 5g/m<sup>2</sup>. The ink fixation layer was prepared on this ink absorption layer. After preparing an ink fixation layer on the same constituent and same conditions as an example 1, it performed calender processing on the same conditions as an example 1, and obtained the ink jet record sheet of an example 4.

[0044] Example of comparison 1 base material was obtained like the example 1. The following application constituents were prepared on this base material. The application constituent used as the principal component the polyvinyl alcohol 30 section used in the example 1 not using the cationic colloidal particle as the anionic colloidal particle (Snow tex 40; particle diameter [ of 15nm ]:Nissan Chemical Industries, Ltd. make) 100 section, and adhesives, and it prepared it so that it might become 20% of solid content concentration. Using the air knife coater, coating of this coating liquid was carried out so that it might be set to the amount of desiccation coating of 5g/m<sup>2</sup>, and it dried so that the moisture after desiccation might become 6%. Subsequently, calender processing is performed on the same conditions as an example 1, and it is ink jet record sheet \*\*\*\* of the example 1 of a comparison.

[0045] Example of comparison 2 base material was obtained like the example 1. The following application constituents were prepared on this base material. The application constituent used as the principal component the porous composition amorphous silica (fine seal X37B: Tokuyama Soda Co., Ltd. make) 100 section, the cationic color fixing agent (poly fix 601: Showa High Polymer Co., Ltd. make) 20 section, and the polyvinyl alcohol 30 section used in the example 1 not using the cationic colloidal particle, and it prepared it so that it might become 15% of solid content concentration. Using the air knife coater, coating of this coating liquid was carried out so that it might be set to the amount of desiccation coating of 5g/m<sup>2</sup>, and it dried so that the moisture after desiccation might become 6%. Subsequently, calender processing is performed on the same conditions as an example 1, and it is ink jet record sheet \*\*\*\* of the example 2 of a comparison.

[0046] Although example of comparison 3 base material and the ink fixation layer were obtained like the example 1, calender processing was not performed but the ink jet record sheet of the example 3 of a comparison was obtained.

[0047] Example of comparison 4 base material and the ink fixation layer were obtained like the example 1. Subsequently, using the supercalender equipment of the number of 4 nips which consists of a metal roll with a skin temperature of 50 degrees C and a cotton roll, calender processing was performed by the linear pressure of 100kg/cm, and rate 200 m/min, and the ink jet record sheet of the example 4 of a comparison was obtained.

[0048] Example of comparison 5 base material and the ink fixation layer were obtained like the example 1. Subsequently, only the linear pressure was changed into 200 kg/cm among the calender processing conditions of the example 4 of a comparison, calender processing was performed, and the ink jet record sheet of the example 5 of a comparison was obtained.

[0049] The assessment result of examples 1-4 and the examples 1-5 of a comparison is shown in a table 1. In addition, the following approaches estimated the evaluation criteria in a table 1.

[0050] (Ink absorption nonuniformity) Solid printing of two colors (green) which consist of cyanogen ink and yellow ink was performed using the ink jet printer (BJC820J: Canon, Inc. make), and it asked for the coefficient of variation of the optical reflection density in this solid printing section in the following procedures. It is possible for spots to have occurred in the solid printing section, if this coefficient of variation is large, and to measure extent of ink absorption nonuniformity. The value of this coefficient of variation of the ink absorption nonuniformity which does not pose a problem practically is 0.5 or less.

- \*\*\*\* -- beforehand, with a cyanogen filter, input the solid printing section into the image-analysis equipment with which optical reflection density carried out linear transform of the known ( $d=0.5-1.8$ ) calibration card to 8-bit gradation, and ask for coefficient of variation ( $L_{std}/L_{ave}$ ) from the average gradation ( $L_{ave}$ ) and standard deviation ( $L_{std}$ ) of this solid printing section. optical reflection density [ in / here / image-analysis equipment ]  $d=0.5$  -- a zero gradation value -- it is --  $d=1.8$  -- a 255 gradation value -- 2 cost 0.1mm per pixel.

[0051] (Wave of a sheet) The sample of each example and the example of a comparison was put on a desk, the oblique light was applied to the front face of each sample, and the following criteria estimated extent of a wave.

A: A wave is not accepted.

B: A wave is small and does not spoil a fine sight.

C: A wave is large and spoils a fine sight greatly.

A and B assessment do not pose a problem practically.

[0052] (Water resisting property) The rate of hypertrophy of the diameter of a dot by moisture adhesion estimated. After putting the sample of each example and the example of a comparison gently on the bottom of the environment of 20 degree C and 65RH% for 24 hours, using the ink jet printer (BJC820J: Canon, Inc. make), the dot was printed in black ink and it put gently on the bottom of this environment for 24 hours. Subsequently, after measuring the projected area diameter computed by following several 1 as a diameter of a dot (D65), the leveling up of each sample was carried out to the bottom of the environment of 40 degree C and 60RH% for 48 hours, and the diameter of a dot (D90) was again measured by several 1. The rates of hypertrophy of the diameter of a dot (D90/D65) are 1.0 or more values, and they serve as a value near 1.0, so that they have a water resisting property.

[0053]

[Equation 1]  $D_i = \{(4/\pi) \times A_i\}$  It is the variable ( $i=65$  or  $90$ ) which shows the conditions by which the projected area diameter was measured for  $D_i$  and the location survey area of a dot and  $i$  were measured for  $A_i$  here  $1/2$ . In addition, using image-analysis equipment, the location survey area of a dot inputted the dot with the optical microscope, performed binary-ized processing by the mode method, and measured.

[0054]

[A table 1]

実施例 及び 比較例	インク吸収 ムラ (変動係数)	シート の うねり	ドット径の 肥大化率 L
実施例1	0.35	A	1.05
実施例2	0.39	A	1.08
実施例3	0.41	A	1.07
実施例4	0.20	A	1.06
比較例1	0.85	A	1.35
比較例2	0.35	A	1.41
比較例3	0.34	C	1.10
比較例4	0.50	C	1.08
比較例5	0.89	B	1.06

[0055] The waterproof thing to excel is shown by the examples 1-4 and the examples 3-5 of a comparison which prepared the ink fixation layer which consists of a constituent which makes a cationic colloidal particle a subject so that clearly from a table 1.

However, in the examples 3-5 of a comparison which have not carried out calender processing with the calender equipment which consists of a synthetic-resin roll and a metal roll, in order to cancel external waviness, when it is difficult to cancel the wave of a sheet and it makes calender processing conditions severe, it is shown that generating of ink absorption nonuniformity arises. Moreover, it is shown by the activity of the calender equipment concerning this invention in the examples 1 and 2 of a comparison that the wave is canceled. Furthermore, from examples 1 and 2, from that the base material which

consists of a constituent which makes wood pulp a subject is excellent in respect of ink absorption nonuniformity, and examples 1 and 4, when an ink absorption layer is prepared on a base material, it is shown that ink absorption nonuniformity is further excellent.

[0056]

[Effect of the Invention] According to the ink jet record sheet of this invention, generating of ink absorption nonuniformity used as deterioration of image quality and grace can be mitigated, the wave of a sheet can be canceled, and the ink jet record sheet which controlled hypertrophy of the diameter of a dot by the moisture adhesion demanded in recent years can be obtained.